

# **Radiation Safety/Radiofrequency Radiation Hazards**

**LG #14**

# **A. Background**

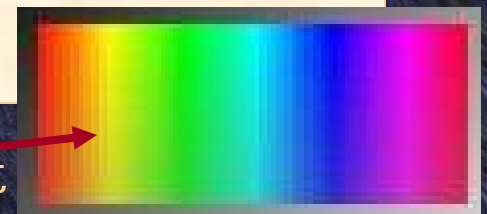
# Radiation

*Radiation is energy transmitted through space in the form of electromagnetic waves (“rays”) or particles*

## ☛ **Electromagnetic waves include**

- ▮ **Radiofrequency (RF) radiation**
- ▮ **Microwaves**
- ▮ **Infrared, visible, and ultraviolet light**
- ▮ **X-rays and gamma rays**

**Spectrum of visible light**



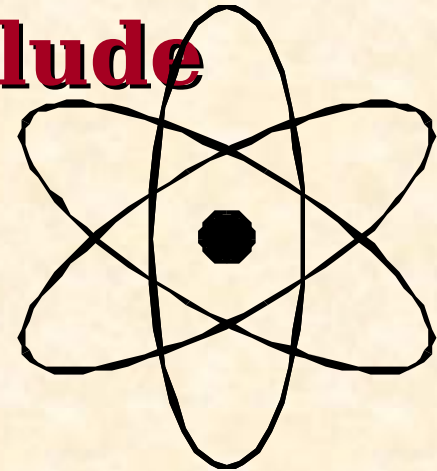
# Radiation

☞ **Nuclear particles include**

$\alpha$  **Alpha particles**

$\beta$  **Beta particles**

$\gamma$  **Neutrons**



# Ionizing Radiation

*Radiation with sufficient energy to strip away electrons from atoms in the media which it passes through*

☛ **Ionizing radiation includes the following:**

$\alpha$  **Alpha particles**

$\beta$  **Beta particles**

$\square$  **Neutrons**

$\square$  **X-rays**

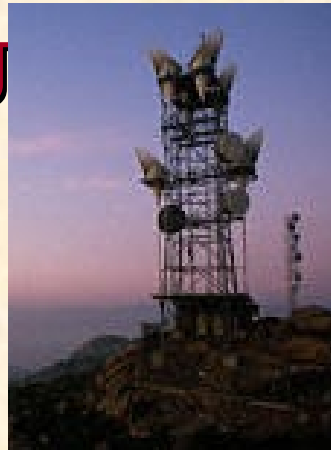
$\gamma$  **Gamma rays**

# Non-Ionizing Radiation

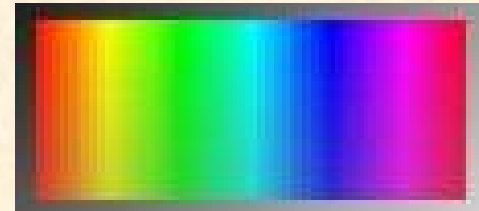
*This is less energetic radiation not capable of stripping electrons*

☛ **Non-ionizing radiation includes the following**

- ☐ **Microwaves**
- ☐ **Radio waves**
- ☐ **Visible light**
- ☐ **Infrared light**
- ☐ **Ultraviolet light**
- ☐ **Laser radiation**



Microwaves



Visible Light



Laser



# **Ionizing & Non-Ionizing Radiation**

*Both types of radiation are potentially hazardous, and can cause serious occupational illness if exposures exceed acceptable limits.*

## **B. Ionizing Radiation**



# Radioactive Material

## ☛ Small quantities found in:

- ☐ Nuclear weapons & propulsion materials
- ☐ Electron tubes
- ☐ Smoke detectors
- ☐ Compasses
- ☐ Luminous markers
- ☐ Depth gages



## ☛ Pose little hazard unless damaged and release material which could enter the body

# Radioactive Material

## ☛ **Missile & aircraft metal may contain thorium**

- ▢ Only hazardous during cutting or grinding
- ▢ Ship's crew prohibited from conducting work practices involving thorium

## ☛ **Detection devices used in CBR warfare have radioactive sources**

- ▢ Enclosed and pose little hazard
- ▢ Meter repair done by tender or shore facilities

## **C. X-Ray Radiation**

# **X-Ray Equipment**

- **Found in Medical & Dental Departments**
- **Facilities monitored periodically**
- **Technicians' exposures monitored with dosimeters**
- **Patient precautions defined in medical directives**



# **X-Ray Machines**

- ☛ **Used on tenders and aircraft carriers**
- ☛ **Used for industrial radiography**
- ☛ **Periodically inspected for procedural compliance**
- ☛ **Strict procedures ensure protection of technicians and other personnel**



## **D. Non-Ionizing Radiation**



# Equipment

- **Radar, communications equipment (transmitting antennas), & heat sealing machines may emit hazardous levels of radiofrequency (RF) or microwave radiation.**



# **Non-Ionizing Hazards**

- ☛ **Exposure may cause heating of body tissues**
- ☛ **May cause shocks and burns**
- ☛ **May cause premature activation of electro-explosive devices**
- ☛ **May cause arcs which could ignite nearby flammable material**

# Putting in the Controls

## ☛ **Surveys conducted by NAVSEASYS COM**

- ▢ **Determines safe and danger zones**
- ▢ **Red lines used to mark unsafe areas**
- ▢ **Warning signs and labels posted at access points where RF levels may exceed the Permissible Exposure Limit (PEL)**
- ▢ **Where levels may exceed the PEL by 10 times, flashing lights, audible signals, & barriers may be needed to protect personnel**
- ▢ **PPE not normally authorized for routine protection against hazardous RF levels**

# **E. Lasers**

# Equipment

- ☛ **Optical systems**
- ☛ **Range finders**
- ☛ **Landing systems**
- ☛ **Communications equipment**

*Note: Laser equipment is becoming increasingly more common aboard ship*



# The Danger

- ☛ **Target organ is the eye**
  - ▮ Can suffer permanent or disabling injury from unprotected exposure
- ☛ **Some lasers may cause skin burns**
- ☛ **Lasers classified as to the hazard**
  - ▮ Hazard classification determines level of protection and required precautions

*Laser eyewear* →





# Other Light Sources

## ☛ **Ultraviolet, visible, and infrared**

- ▮ **May cause damage to the skin and eyes**

## ☛ **Types of lamps include**

- ▮ **Germicidal lamps**
- ▮ **Phototherapy lights**
- ▮ **Sun & tanning lamps**



# **F. The Navy's Radiation Protection Program**

# **Program Elements**

- ☛ **Identifying and evaluating radiation sources**
- ☛ **Using dosimetry to monitor exposures to ionizing radiation**
- ☛ **Medical surveillance**
- ☛ **Investigating and reporting radiation incidents**
- ☛ **Training**

# **Program Purpose**

- ☛ **To prevent personnel from exposure and monitor potential exposures. Medical surveillance is used to verify whether biological changes are occurring.**

## **F. Medical Surveillance**

# **“This Won’t Hurt at All”**

- ☛ **Surveillance consists of preplacement and periodic examinations**
- ☛ **Ionizing radiation exposure monitoring involves wearing a dosimeter**
  - **Applies to all personnel having potential for exposure**



# **“Next!”**

## **☛ RFR medical surveillance required**

- ☐ If personnel who work with RF equipment capable of creating exposure greater than PEL listed in directives**
- ☐ Preplacement or baseline exam required**
- ☐ Periodic exams given only if RFR levels greater than 5 times the PEL**

# **What About Lasers?**

- ☛ **Laser medical surveillance limited to those personnel at risk of exposure to laser radiation**
- ☛ **Separate directives tell medical personnel**
  - **What tests to conduct**
  - **What symptoms to be aware of**